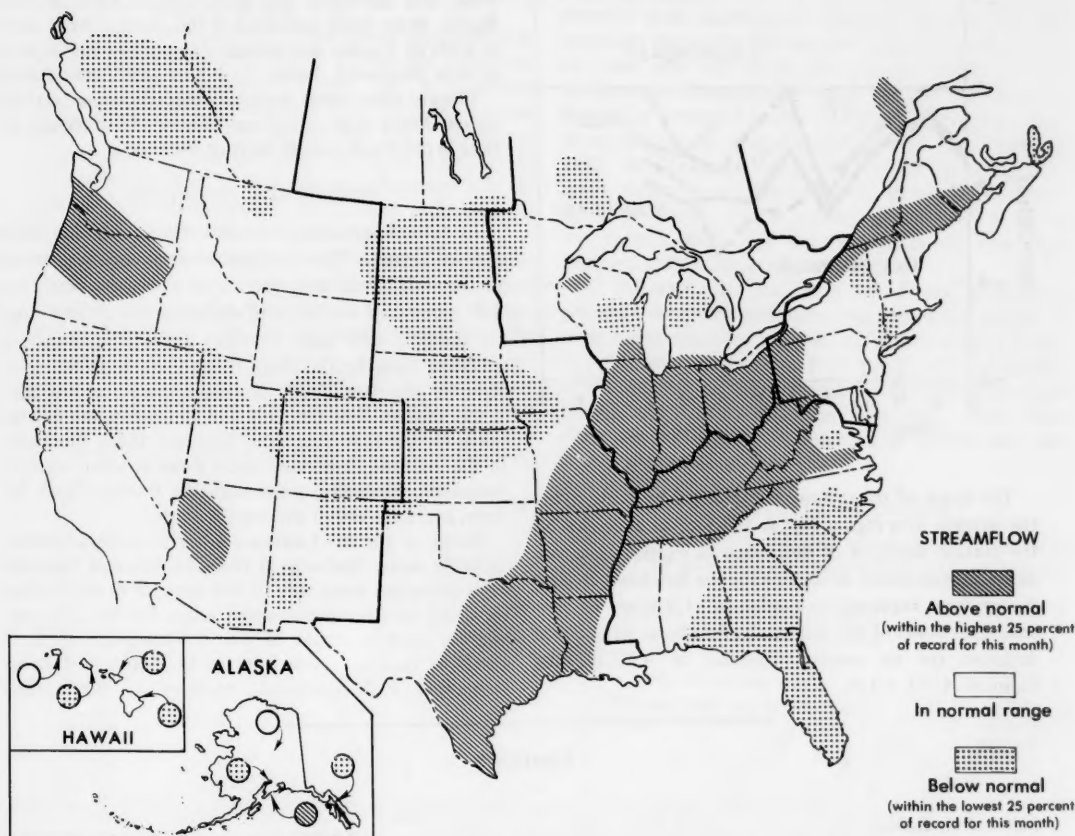


# WATER RESOURCES REVIEW for JUNE 1981

UNITED STATES  
DEPARTMENT OF THE INTERIOR  
GEOLOGICAL SURVEY

CANADA  
DEPARTMENT OF THE ENVIRONMENT  
WATER RESOURCES BRANCH

## STREAMFLOW DURING JUNE



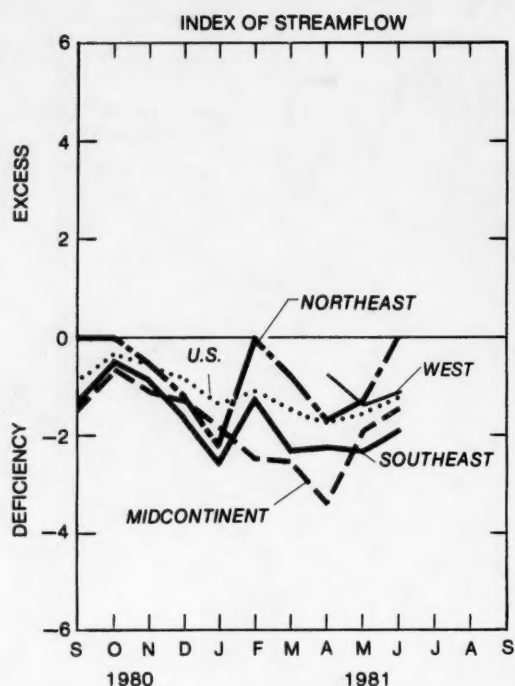
## STREAMFLOW AND GROUND-WATER CONDITIONS

Several large areas of below-normal streamflow persisted in the Southeast and in central and northern parts of the West and Midcontinent Regions, along with smaller areas in western Connecticut, eastern New York, southwestern Ontario, and southern Arizona. Monthly mean flows were lowest of record for June in parts of Alaska, Florida, Georgia, Hawaii, and Virginia.

Streamflow was above the normal range in a large area encompassing the Ohio River basin and southern parts of the Midcontinent Region, along with smaller areas of above-normal flow located in the Northeast Region and in parts of Arizona, Oregon, Washington, and Wisconsin. Monthly mean discharges were highest of record for the month in parts of Ohio and Texas. Flooding during the period June 9–15 in Illinois, Indiana, Iowa, Kansas, Louisiana, Missouri, Ohio, Texas, and Wyoming resulted from heavy rains early in the month, augmented by meltwater runoff from snow in northwestern Wyoming. Peak discharges of several streams exceeded those likely to occur only once in 100 years.

Ground-water levels declined in most of the Northeast Region. Levels were slightly above and below average in most States, but were considerably above average in southwestern Pennsylvania and eastern Maine. Levels were below average in most other coastal parts of New England, and in central New Jersey and most of Delaware and Maryland. In the Southeast Region, levels rose in Kentucky, and declined in Alabama, Mississippi, North Carolina, and Tennessee. Trends were mixed in Florida, Georgia, Virginia, and West Virginia. Levels were above average in Kentucky, above and below average in West Virginia, and below average elsewhere in the region. In the Western Great Lakes Region, levels rose in Illinois, and declined in Minnesota and Ohio. Trends were mixed in other States. Levels were near or above average in Illinois and Ohio, below average in Minnesota, and above and below average in Michigan. In the Midcontinent Region, levels rose in Iowa, and declined in Arkansas, Kansas, Nebraska, and North Dakota. Trends were mixed in other States. Levels were below average in Arkansas, Kansas, Nebraska, and North Dakota, and were above and below average in Iowa, Louisiana, and Texas. In the West, levels declined in Utah. Trends were mixed in other States. Levels were below average in Arizona and Montana, and generally above and below average elsewhere in the region.

New high ground-water levels for June were reached in West Virginia, Illinois, Ohio, and Utah. New June lows occurred in Mississippi, Tennessee, Virginia, Kansas, North Dakota, Arizona, Idaho, New Mexico, and Utah. New alltime lows were reached in Texas, Arizona, and Idaho, and a new alltime high was reached in Nevada.



The index of streamflow is computed by multiplying the percent of a region that is deficient or excessive by the average duration of deficiency or excess. Thus, the index of streamflow deficiency for the Southeast Region during June improved to a value of -1.9 when 44 percent (i.e., 0.44) of the area in the Southeast Region was deficient for an average duration of 4.25 months ( $0.44 \times 4.25 = 1.9$ ).

## NORTHEAST

[Atlantic Provinces and Quebec; Delaware, Maryland, New York, New Jersey, Pennsylvania, and the New England States]

*Streamflow generally decreased seasonally in the Atlantic Provinces, Quebec, Connecticut, New Jersey, and central New England, and was variable elsewhere in the region. Monthly mean flows remained in the below-normal range in parts of Connecticut and New York, and decreased into that range in parts of Nova Scotia. Mean flows remained in the above-normal range in parts of Quebec and increased into that range in parts of New Brunswick, Maine, New York, and Pennsylvania.*

*Ground-water levels declined seasonally in most of the region. Levels near end of month were about average for June in most non-coastal parts of the region.*

## STREAMFLOW CONDITIONS

In extreme southern New Brunswick, monthly mean flow of Lepreau River at Lepreau increased, in contrast to the normal seasonal pattern of decreasing flow, was 267 percent of median, and was above the normal range for the first time since February 1981. By contrast, in northern Nova Scotia, mean flow of Northeast Margaree River at Margaree Valley decreased sharply to less than  $\frac{1}{2}$  the median flow for June and was below the normal range for the first time since February 1980. Elsewhere in the Atlantic Provinces, mean flows at index stations decreased seasonally, were near the median flows for June, and were within the normal range.

North of the St. Lawrence River in eastern Quebec, monthly mean discharge of Outardes River at Outardes Falls decreased seasonally to 141 percent of median but remained in the above-normal range for the 5th consecutive month. South of the St. Lawrence River in southern Quebec, mean flow of St. Francois River at Hemmings Falls increased, contrary to the normal

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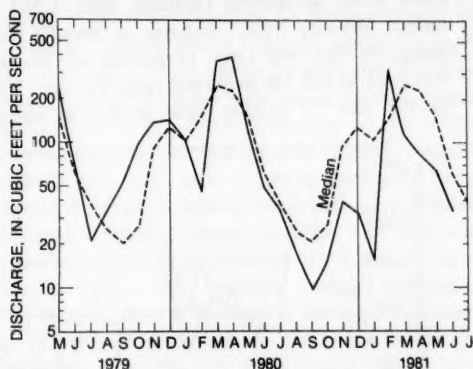
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seasonal pattern, was more than twice the median flow, and was above the normal range. Elsewhere in the Province, monthly mean flows decreased seasonally and were near the median flows for June.

In central Maine, where monthly mean flow of Piscataquis River near Dover-Foxcroft was below the normal range in April and May, mean discharge increased, contrary to the normal seasonal pattern, and was above the normal range. Mean flows at index stations in northern and southern parts of the State were above median but within the normal range.

In central New England, streamflow decreased seasonally and was generally below median but within the normal range. Exceptions were in southwestern Massachusetts and southeastern New Hampshire where mean flows were below the normal range. Storage in major reservoirs remained about the same as last month and ranged from 81 to 104 percent of average near the end of June. Total content of all index reservoirs was about 97 percent of that of a year ago.

In northwestern Connecticut, monthly mean discharge of Burlington Brook near Burlington continued to decrease seasonally, was only 44 percent of median, and remained in the below-normal range for the 4th consecutive month. Similarly, in the southwestern part of the State, flow of Pomperaug River at Southbury decreased seasonally to 54 percent of median, and was below the normal range for the 9th time in the past 10 months. (See graph.) Reservoir systems for Hartford,



Monthly mean discharge of Pomperaug River at Southbury, Conn. (Drainage area, 75.0 sq mi; 194.2 sq km)

Bridgeport, and Waterbury were near normal at month-end and the system for Stamford was 68 percent of normal.

In northern New York, monthly mean discharge of Hudson River at Hadley decreased seasonally to 56 percent of median and remained in the below-normal range for the 3d consecutive month. Farther northwest, runoff from heavy rains late in the month brought streamflow at West Branch Oswegatchie River near Harrisville into the above-normal range for the first time

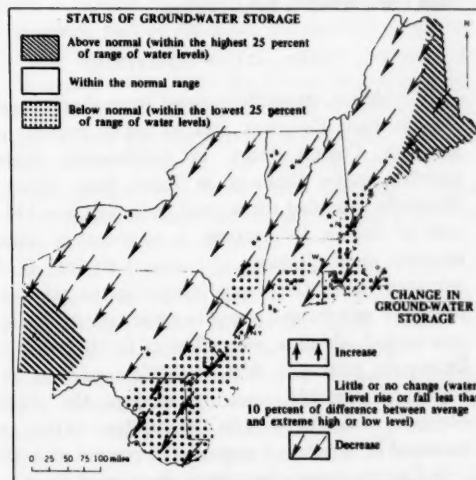
since February 1981. On Long Island, mean flow of Massapequa Creek at Massapequa increased, contrary to the normal seasonal trend, but was only 56 percent of median and remained in the below-normal range for the 10th consecutive month. In the western part of the State, streamflow was above median but within the normal range except in the Allegheny River at Salamanca where flows remained in the above-normal range.

In the adjacent area of northwestern Pennsylvania, monthly mean discharge of Allegheny River at Natrona decreased seasonally but was over twice the median flow for June and was above the normal range. Also in northwestern Pennsylvania, mean flow of Oil Creek at Rouseville increased to 287 percent of median and was above the normal range for the first time since February 1981. In the southwestern part of the State, monthly mean discharge of Monongahela River at Braddock increased sharply to 526 percent of median, was above the normal range, and was over twice the flow that occurred at that site during May.

In Delaware, Maryland, and New Jersey, streamflow generally decreased seasonally, was above the median at most index stations, and was within the normal range. For example, in northern New Jersey, where monthly mean discharge of South Branch Raritan River near High Bridge was highest of record for May, mean flow decreased sharply to 135 percent of median, and was within the normal range.

#### GROUND-WATER CONDITIONS

Ground-water levels declined seasonally in most of the region. (See map.) Levels near end of June were only



Map shows ground-water storage near end of June and change in ground-water storage from end of May to end of June.

slightly below or above average in much of the region. However, levels were considerably above average in southwestern Pennsylvania and eastern Maine; and were below average in most other coastal parts of New England, as well as in central New Jersey and most of Delaware and Maryland.

## SOUTHEAST

[Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee, Virginia, and West Virginia]

*Streamflow increased, contrary to the normal seasonal trend, and was above the normal range in the western part of Virginia, West Virginia, Kentucky, Tennessee, western North Carolina, and northern Alabama; streamflow decreased seasonally and remained below the normal range on the eastern Piedmont of North Carolina and coastal areas of South Carolina, Georgia, Florida, and southeastern Alabama. Streamflow in Mississippi was in the normal range. Drought conditions continued in central Virginia, southern Georgia, and central and southern portions of Florida. Record-low flow data were also observed in parts of Florida, Georgia, and Virginia.*

*Ground-water levels rose in most wells in Kentucky, and declined in most wells in Alabama, Mississippi, North Carolina, and Tennessee. Trends were mixed in Florida, Georgia, Virginia, and West Virginia. Levels were generally above average in Kentucky, above and below average in West Virginia, and below average elsewhere. New record lows for June were reached in Mississippi, Tennessee, and Virginia, and a new record high was reached in West Virginia.*

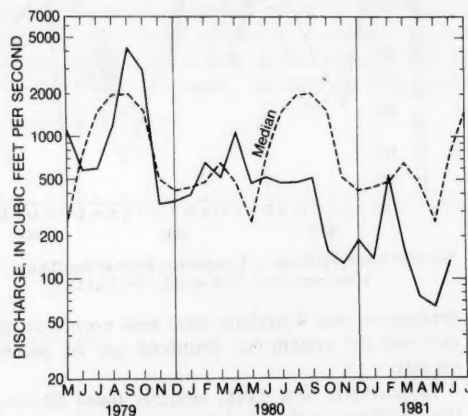
### STREAMFLOW CONDITIONS

In Alabama, streamflow varied from above normal in the northern Piedmont area to below normal in the southern Coastal Plain. In northeastern Alabama, monthly mean discharge in Paint Rock River near Woodville exceeded the normal range and was 535 percent of median. By contrast, in southeastern Alabama, monthly mean discharge of Conecuh River at Brantley remained below the normal range for the 6th time in the past 7 months and was only 44 percent of median. In west-central Alabama, mean flow of Tombigbee River at Demopolis lock and dam, near Coatopa, was in the normal range at 121 percent of median. Also in central Alabama, mean discharge in Cahaba River at Centreville remained in the normal range at 125 percent of median.

In Georgia, streamflow was in the normal range in the northern part of the State and below the normal range elsewhere. In northern Georgia, monthly mean discharge

in Etowah River at Canton was 97 percent of median, and increased from May, in contrast to the normal seasonal pattern. In western Georgia, flow of Flint River near Culloden decreased seasonally, was 54 percent of median, and was below the normal range for the 5th time in the past 7 months. In southern Georgia, the monthly mean discharge of Alapaha River at Statenville (drainage area, 1,400 square miles) was the lowest for June in 51 years of record and marked the 7th consecutive month of below-normal flow. In southeastern Georgia, monthly discharge in Altamaha River at Doctortown decreased seasonally and was below the normal range for the 7th time in the past 9 months.

In Florida, mean discharges for the month were in the below-normal range and, except for central Florida, mean discharges decreased seasonally. In north-central Florida, mean flow of Apalachicola River at Chattahoochee was 56 percent of median and was in the below-normal range for the 6th time in the past 8 months. Similarly, mean flow of Shoal River near Crestview in northwestern Florida remained in the below-normal range for the 6th time in the past 7 months, and was 59 percent of median. In north-eastern Florida, mean flow of Suwannee River at Branford was only 50 percent of median. In west-central Florida, the daily mean flow of 38 cfs on June 2 was the lowest for June in 51 years of record at Peace River at Arcadia (drainage area, 1,367 square miles). Monthly mean discharge at Arcadia increased seasonally but was only 18 percent of median and remained in the below-normal range for the 11th time in the past 12 months. (See graph.) In east-central



Monthly mean discharge of Peace River at Arcadia, Fla.  
(Drainage area, 1,367 sq mi; 1,424 sq km)

Florida, the monthly mean discharge of 31.8 cfs in St. Johns River near Christmas (drainage area, 1,539 square

miles), was the second lowest for June and the 4th lowest for the period of record that began in 1933. Cumulative runoff for the first 9 months of the 1981 water year at this station was only 21 percent of median. In southern Florida, Fisheating Creek at Palmdale (drainage area, 311 square miles) had no flow for the entire month. Lake Okeechobee declined to 10.29 feet at monthend which was below the design dead storage of 10.50 feet.

In Kentucky, streamflow, contrary to the normal seasonal trend, increased and far exceeded the normal range. The excessive discharges were mostly due to runoff from heavy thunderstorms during the early part of the month. In northern Kentucky, mean discharge of Licking River at Catawba was 7.2 times the median discharge. Similarly, in the southern part of the State, mean discharge in Green River at Munfordville was over 6 times the median discharge. Some flash flooding occurred in southeastern Kentucky during the early part of the month.

In Mississippi, streamflow decreased slightly but remained in the normal range. In the western part of the State, mean discharge in Big Black River at Bovina was 180 percent of median and remained in the normal range for the 3d consecutive month. In the southeastern part of the State, mean discharge in Pascagoula River at Merrill was 110 percent of median.

In North Carolina, flows in most streams were in the normal to above-normal range for the first time in over 6 months. Locally heavy, scattered rainfall during the first two weeks of the month caused minor flooding in isolated areas. A wide variation in rainfall amounts occurred across the State. According to the National Weather Service, the Raleigh area (eastern Piedmont) received only 0.55 inch of rainfall during the month, making it the driest June in almost 100 years. However, Greenville (Coastal Plain) received 7.07 inches and Catawba (western Mountains) 10.50 inches. In the Coastal Plain, the monthly mean discharge in Contentnea Creek at Hookerton increased significantly to 142 percent of median and was in the normal range following 6 months of below-normal flow. In the eastern Piedmont, mean flow in Cape Fear River at William O. Huske Lock near Tarheel was 60 percent of median, and was below the normal range for the 7th consecutive month. Monthly flow in the Deep River at Moncure increased to 62 percent of median and was in the normal range for the first time since February 1981. In the central Piedmont, monthly mean discharge of South Yadkin River near Mocksville was 205 percent of median and was above the normal range following 6 consecutive months of below-normal flow. In the

western part of the State, mean flow in French Broad River at Asheville decreased slightly and was in the normal range after 6 consecutive months of below-normal flow.

In South Carolina, monthly mean flow increased, in contrast to the normal seasonal pattern of decreasing flow, but remained below median and, except for the Lynches River basin, was in the normal range. In the northeastern part of the State, the mean discharge in Pee Dee River at Pee Dee increased significantly to 91 percent of median and was in the normal range following 6 months of below-normal flow. However, mean discharge in Lynches River at Effingham remained in the below-normal range for the 6th consecutive month.

In Tennessee, streamflow increased in contrast to the normal seasonal pattern and was above the normal range throughout the State. In west-central Tennessee, where mean flow in the Buffalo River near Lobelville was below the normal-range in May, flow increased sharply and was above the normal range at 155 percent of median. In the north-central part of the State, monthly mean discharge in Harpeth River near Kingston Springs also increased significantly to over 3.5 times median. In eastern Tennessee, mean flows in Emory River at Oakdale and French Broad River below Douglas Dam both increased sharply and were above the normal range at 414 and 175 percent of median, respectively.

In Virginia, streamflow ranged from above-normal in western and southern parts of the State to record lows in central Virginia. In northern Virginia, monthly mean flow in Rapidan River near Culpeper increased to 111 percent of median and was in the normal range after 3 months of flow in the below-normal range. In the central part of the State, the monthly mean flow of 37 cfs in Slate River near Arvonion (drainage area, 226 square miles) was the lowest for the month in 55 years of record, and the daily flow of 11 cfs on June 29 was also the record-low daily flow for June. In southeastern Virginia, the monthly mean flow in Nottoway River near Stony Creek increased, in contrast to the normal seasonal pattern and was above the normal range at 286 percent of median.

In West Virginia, streamflow increased sharply, in contrast to the normal seasonal trend, and exceeded the normal range. Heavy rain in the upper Gauley River basin on June 10 brought a new maximum stage of 9.21 feet in the Cranberry River at Richwood. Problems with standing water and localized flooding were common phenomena. In extreme northern West Virginia, mean flow of Potomac River at Paw Paw was 2.7 times median; in the western part of the State, Kanawha River at Kanawha Falls was 2.9 times median;

and in the southeastern part, Greenbrier River at Alderson was 3.9 times median.

#### GROUND-WATER CONDITIONS

In Alabama, ground-water levels fell nearly 2 feet at Montgomery and 1 foot at Centerville, and continued to be slightly below average for this time of year.

In Florida, ground-water levels generally declined in the northern part of the State, but rose in some areas in the west-central peninsular part of the State. Declines ranged from less than one foot in Jacksonville to 14 feet near Pensacola. In contrast, levels rose about 1.8 feet near Tampa and 8.2 feet near Mulberry in west-central Polk County. End-of-month levels ranged from 2.8 feet below average at Tallahassee to 18.3 feet below average near Mulberry. In southeast Florida, data collected from 56 observation wells in four counties show that ground-water levels rose at 43 sites since the end of May. The lowest average change was 0 foot in 14 wells in St. Lucie and Palm Beach Counties. The highest average change was 0.71 foot in Broward County and 0.50 and 0.33 foot in north and central Dade County, respectively.

In Georgia, ground-water levels in the Piedmont ranged from 0.3 foot higher to 1 foot lower than in May, and were as much as 2.2 feet lower than in June 1980. In the coastal counties, water levels in the principal artesian aquifer were as much as 4 feet lower than last month. Near Savannah, levels were 2 to 3 feet lower. The level in the water-table aquifer declined, but remained about 3 feet below median, and about 0.5 foot above the record low for June.

In Kentucky, ground-water levels generally rose in response to above-average precipitation, and were above average in most areas of the State.

In Mississippi, ground-water levels declined at all reporting stations. Levels in wells screened in the Sparta Sand in the Jackson metropolitan area declined from 1 to 6 feet during June because of increased ground-water withdrawals for industrial and municipal uses. Record low levels were established at a number of sites. Slight declines of less than 2 feet were indicated in the Miocene and the Graham Ferry Formations along the Gulf Coast, with the exception of a few observation wells near pumping sites where greater declines were noted. In northern Mississippi, water levels in the Wilcox aquifer and upper Cretaceous aquifers declined moderately, with the exception of the Tupelo area where water levels influenced by heavy pumping declined more than 2 feet. Levels in the Tupelo area are now 4 to 5 feet higher than during record lows established in the summer of 1979.

In North Carolina, ground-water levels fell slightly across the State and were 1 to 3 feet below long-term averages at key wells.

In western Tennessee, the level in the key artesian well in the "500-foot" sand aquifer near Memphis declined 0.5 foot, reaching a new June low in 40 years of record.

In Virginia, ground-water levels in 3 key wells ranged from a 1.1-foot rise in the southeastern part of the State, to a 0.6-foot rise in the central part of the State. Water levels were 0.4 to 9.2 feet below average for these wells, and 0.6 to 10.7 feet below corresponding readings taken at this time last year. The level in the Tyler observation well in Louisa County set a new record low for the month of June in 29 years of record. This is the 4th consecutive month that new record lows have been established for this well. The other 2 key wells showed a small rise in water levels as a result of heavy rains near the end of last month and early in this month.

In West Virginia, ground-water levels rose in Braxton, Monongalia, and Wayne Counties and declined elsewhere in the State. Levels were above average in the northwestern part of the State, and below average elsewhere. The level in the key well at Glenville in Gilmer County reached a record high for the month of June in 27 years of record.

#### WESTERN GREAT LAKES REGION

[Ontario; Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin]

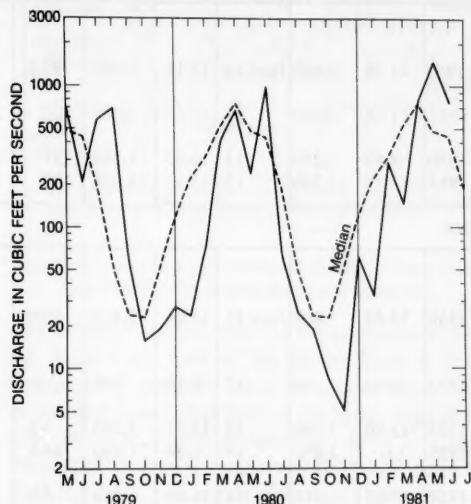
*Streamflow generally increased in Minnesota and Ohio, decreased in Ontario and Michigan, and was variable elsewhere in the region. Monthly mean flows remained in the below-normal range in parts of Ontario and Minnesota, and decreased into that range in parts of Michigan and Wisconsin. Mean flows remained above the normal range in parts of Illinois, Indiana, and Ohio, and were highest of record for June in parts of Ohio. Flooding occurred in Illinois, Indiana, and Ohio.*

*Ground-water levels rose in Illinois and declined in Minnesota and Ohio; trends were mixed in other States. Levels were near or above average in Illinois and Ohio, below average in Minnesota, and above and below average in Michigan. New record highs for the month of June were reached in Illinois and Ohio.*

#### STREAMFLOW CONDITIONS

In extreme northeastern Illinois, severe flooding occurred near midmonth along several tributaries of Illinois River as a result of rapid runoff from intense rainfall. Peak discharges on June 13 at gaging stations

on Thorn Creek, Butterfield Creek, Tinley Creek, and Hickory Creek, were greater than those of a 100-year flood at the respective sites. Selected data on stages, discharges, recurrence intervals, and locations for those gaging stations, are given in the accompanying map and table. Near monthend, the National Weather Service reported flooding along Illinois and Big Muddy Rivers, in eastern and southern parts of the State, respectively. In central Illinois, monthly mean flow of Sangamon River at Monticello decreased seasonally but remained in the above-normal range. (See graph.) Similarly, in the



Monthly mean discharge of Sangamon River at Monticello, Ill. (Drainage area, 550 sq mi; 1,424 sq km)

northwestern part of the State, mean discharge of Rock River near Joslin decreased seasonally but remained above the normal range.

In Indiana, flooding occurred early in the month along Salamonie and Mississinewa Rivers in the upper part of Wabash River basin. Damage was reported to have been confined to agricultural areas. Flooding occurred June 10 in the south-central part of the State where peak stages on most streams were the highest since January 1959. Record-high stages and discharges occurred during the flooding in northern Indiana near midmonth along tributaries of Wabash and Illinois Rivers. Selected data on stages, discharges, recurrence intervals, and gaging station locations are given in the accompanying table and map.

In northern Ohio, rapid runoff from intense thunderstorms on June 13, 14, resulted in minor flooding on numerous small streams. Selected data on stages, discharges, recurrence intervals, and gaging station locations, are given in the accompanying table and map. In

the northwestern part of the State, the monthly mean discharge of 21,640 cfs in Maumee River at Waterville (drainage area, 6,330 square miles) was highest for June in 56 years of record, and was 8 times the median flow for the month. In central Ohio, the mean flow of 14,650 cfs in Scioto River at Higby (drainage area, 5,131 square miles) was highest for June since records began in October 1930, and was 7 times the median discharge for that site. In the northeastern part of the State, monthly mean discharge of Little Beaver Creek near East Liverpool increased, contrary to the normal seasonal pattern, was in the above-normal range, and was 417 percent of median. Storage at monthend in reservoirs in the Scioto River basin upstream from Higby was 95 percent of last month, 101 percent of a year ago, and 104 percent of normal capacity. In the Mahoning River basin, upstream from Newton Falls, monthend storage in reservoirs was 100 percent of last month, 104 percent of a year ago, and 73 percent of capacity.

In southern Michigan, monthly mean flow of Cedar River at East Lansing continued to decrease seasonally and was less than median but remained in the normal range. In the northern part of the Lower Peninsula, monthly mean discharge of Muskegon River at Evart decreased sharply and was below the normal range for the first time since August 1978. In the Upper Peninsula, mean flow of Sturgeon River near Sidnaw also decreased seasonally but remained within the normal range.

In western Ontario, monthly mean flow of English River at Umfreville decreased, contrary to the normal seasonal pattern, was only 46 percent of median, and was below the normal range for the 5th time in the past 6 months. Elsewhere in the Province, streamflow generally decreased seasonally and remained in the normal range.

In eastern Wisconsin, monthly mean discharge of Fox River at Rapide Croche Dam near Wrightstown decreased sharply, was only 58 percent of median, and was below the normal range for the first time since July 1980 as a result of low carryover flow from May and below-normal runoff during June. In the northwestern part of the State, mean flow of Jump River at Sheldon also decreased, but was above the normal range and was more than 2 times the median flow for June as a result of increased runoff from rain at midmonth. Elsewhere in Wisconsin, streamflow was variable and was in the normal range.

In northwestern Minnesota, where monthly mean discharge of Roseau River below State Ditch No. 51 near Caribou (drainage area, 1,570 square miles) was below the normal range in 12 of the past 13 months, mean discharge increased to 362 cfs in June, was 87 percent of median, and was in the normal range.

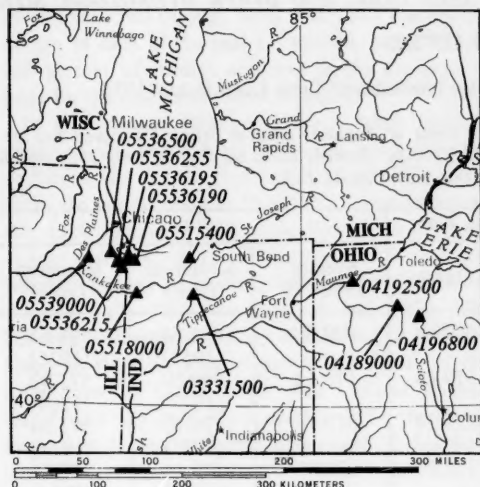
**STAGES AND DISCHARGES FOR THE FLOODS OF JUNE 1981 AT SELECTED SITES IN  
ILLINOIS, INDIANA, AND OHIO**

WRD station number	Stream and place of determination	Drainage area (square miles)	Period of known floods	Maximum flood previously known			Maximum during present flood				
				Date	Stage (feet)	Dis- charge (cfs)	Date	Stage (feet)	Discharge		Recur- rence interval (years)
									Cfs	Cfs per square mile	
<b>ILLINOIS</b>											
<b>ILLINOIS RIVER BASIN</b>											
05536215	Thorn Creek at Glenwood .....	24.7	1949-	Aug. 17, 1968	11.26	2,600	June 13	11.11	2,400	97.2	>100
05536255	Butterfield Creek at Flossmoor .....	23.5	1948-	July 13, 1957	11.78	2,550	13	11.58	2,400	102	>100
05536500	Tinley Creek near Palos Park .....	11.2	1951-	Apr. 30, 1970	9.83	1,270	13	10.02	<sup>1</sup> 1,350	121	>100
05539000	Hickory Creek at Joliet ...	107	1944-	July 13, 1957	13.77	15,200	13	13.35	13,800	129	>100
<b>INDIANA</b>											
<b>WABASH RIVER BASIN</b>											
03331500	Tippecanoe River near Ora .....	856	1943-	Apr. 5, 1950	14.40	7,800	June 15	15.08	9,310	10.9	75
<b>ILLINOIS RIVER BASIN</b>											
05515400	Kingsbury Creek near LaPorte .....	7.08	1970-	Apr. 22, 1973	5.44	44	13	6.18	<sup>1</sup> 68	.....	.....
05518000	Kankakee River at Shelby .....	1,779	1922-	Dec. 21, 1927 <sup>2</sup>	11.40	7,200	22	12.51	5,750	3.2	20
05536190	Hart Ditch at Munster ....	70.7	1942-	Apr. 28, 1959	(3)	2,670	14	8.04	<sup>4</sup> 1,750	24.8	.....
05536195	Little Calumet River at Munster .....	90.0	1958-	Apr. 28, 1959	13.67	1,510	14	16.40	460	5.1	.....
<b>OHIO</b>											
<b>STREAMS TRIBUTARY TO LAKE ERIE</b>											
04189000	Blanchard River near Findlay .....	346	1923-35, 1940-	Feb. 11, 1959	16.76	<sup>2</sup> 12,100	June 14	17.45	13,000	37.6	50
04192500	Maumee River near Defiance .....	5,545	1924-35, 1939-74, 1978-	Feb. 16, 1950	13.70	87,100	15	12.35	76,500	13.8	25
04196800	Tymocktee Creek at Crawford .....	229	1961-	Mar. 17, 1978	9.94	6,390	15	9.16	5,710	24.9	10

<sup>1</sup> Estimated.<sup>2</sup> Site then in use.<sup>3</sup> Maximum gage height, 7.83 feet Oct. 11, 1954.<sup>4</sup> Backwater.<sup>5</sup> Revised.

Also in this part of the State, monthly mean flows of Wild Rice River at Hendrum and Buffalo River near Dilworth were in the below-normal range, and were 39 percent and 30 percent, respectively, of the June medians. In the northeastern part of the State, mean

flow of Basswood River near Winton remained in the normal range. In west-central Minnesota, mean flows of Minnesota River at Montevideo and Pomme de Terre River at Appleton were in the normal range, and mean flow of Chippewa River near Milan increased sharply



Locations of stream-gaging stations in Illinois, Indiana, and Ohio, described in table of peak stages and discharges.

into the above-normal range. In the southwestern part of the State, mean flow of Des Moines River at Jackson increased but remained below the normal range, while in central and east-central parts of the State, mean flows of Crow River at Rockford, Minnesota River near Jordan, Mississippi River near Anoka, and Mississippi River at St. Paul increased into the normal range from the below-normal range.

#### GROUND-WATER CONDITIONS

In Illinois, the key well in glacial drift, at Princeton, Bureau County, rose 2 feet and was 5.3 feet above average. A new monthly high was reached at this well in 38 years of record.

In Indiana, levels in the southwestern part of the State fell about 0.5 foot, but rose about 1 foot in the remainder of the State.

In Michigan, ground-water levels rose in the Upper Peninsula but declined elsewhere. Levels were below average in the south-central part of the Lower Peninsula, but near average in most other areas.

In Minnesota, ground-water levels in shallow water-table wells in the southern part of the State began declining following a two month rise. Levels are now 6 feet below average. Levels in the northern part of the State continued to decline, with some wells showing a small drop in water level for the 7th consecutive month. Levels are generally 3 to 6 feet below average in key wells.

In Ohio, ground-water levels declined in the central part of the State, but remained above average. Levels rose to a new high in the northeastern part of the State.

In Wisconsin, ground-water levels rose in the north-central part of the State, but declined slightly in the rest of the State.

#### MIDCONTINENT

[Manitoba and Saskatchewan; Arkansas, Iowa, Kansas, Louisiana, Missouri, Nebraska, North Dakota, Oklahoma, South Dakota, and Texas]

*Streamflow generally increased in Saskatchewan, Oklahoma, and Texas, generally decreased in Kansas, and varied elsewhere in the region. Monthly mean flows were in the below-normal range at only 8 of the 26 index stations compared with 21 of 26 in April and 11 of 26 in May; flows at 7 of the 26 were in the above-normal range in June, compared with none in that range in May. Monthly flows were highest of record for June in parts of Texas. Flooding occurred in Iowa, Kansas, Louisiana, Missouri, and Texas.*

*Ground-water levels rose in Iowa and fell in Arkansas, Nebraska, and North Dakota; trends were mixed in other States. Levels were below average in Arkansas, Kansas, Nebraska, and North Dakota, and were above and below average in Iowa, Louisiana, and Texas. New lows for the month of June were reached in Kansas and North Dakota, and a new alltime low was reached in Texas.*

#### STREAMFLOW CONDITIONS

In western Louisiana, rapid runoff from intense thunderstorms resulted in a flood-peak discharge of 6,670 cfs in Paw Paw Bayou near Greenwood (drainage area, 80.5 square miles). This was the 3d highest discharge observed at this station since records began in October 1955. In northwestern Louisiana, monthly mean discharge of Red River at Alexandria increased into the above-normal range, from the below-normal range in May, and was 177 percent of median. Mean flow of Saline Bayou near Lucky increased into the above-normal range from the normal range in May, and was 456 percent of median. In the southern part of the State, mean flow of Calcasieu River near Oberlin increased sharply, contrary to the normal seasonal pattern, and was 782 percent of median. Elsewhere in the State, runoff generally was above median and in the normal range.

In southern Arkansas, mean discharge of Saline River near Rye increased sharply, contrary to the normal seasonal pattern, was 841 percent of median, and was above the normal range following 5 consecutive months of below-median flow. Similarly, in northern Arkansas, where mean discharge of Buffalo River near St. Joe was below the normal range for 6 consecutive months

(Continued on page 11.)

## SELECTED DATA FOR THE GREAT LAKES, GREAT SALT LAKE, AND OTHER HYDROLOGIC SITES

## GREAT LAKES LEVELS

Water levels are expressed as elevations in feet above International Great Lakes Datum 1955

(Data furnished by National Ocean Survey, NOAA, via U.S. Army Corps of Engineers office in Detroit. To convert data to elevations in feet above National Geodetic Vertical Datum of 1929 (NGVD), formerly called sea level datum of 1929, add the following values: Superior, 0.96; Michigan-Huron, 1.20; St. Clair, 1.24; Erie, 1.57; Ontario, 1.22.)

Lake	June 30, 1981	Monthly mean, June		June		
		1981	1980	Average 1900-75	Maximum (year)	Minimum (year)
Superior ..... (Marquette, Mich.)	600.82	600.69	600.64	600.67	601.64 (1951)	598.63 (1926)
Michigan and Huron ..... (Harbor Beach, Mich.)	579.42	579.34	579.68	578.54	580.89 (1973)	575.90 (1964)
St. Clair ..... (St. Clair Shores, Mich.)	574.72	574.80	575.24	573.77	576.23 (1973)	571.74 (1934)
Erie ..... (Cleveland, Ohio)	572.33	572.17	572.56	570.96	573.51 (1973)	568.46 (1934)
Ontario ..... (Oswego, N.Y.)	245.56	245.30	245.98	245.55	248.06 (1952)	242.91 (1935)

## LAKE WINNIPEG AT GIMLI, MANITOBA

Alltime high: 718.26 (July 1974). Alltime low: 709.62 (February 1941).	Monthly mean, June				
	1981	1980	Average 1913-80	Maximum (year)	Minimum (year)
Elevation in feet above NGVD:	712.89	714.02	713.98	717.91 (1974)	710.47 (1941)

## GREAT SALT LAKE

Alltime high: 4,211.6 (1873). Alltime low: 4,191.35 (October 1963).	June 30, 1981	June 30, 1980	June		
			Average, 1904-80	Maximum (year)	Minimum (year)
Elevation in feet above NGVD:	4,199.95	4,200.35	4,199.00	4,204.80 (1923)	4,192.75 (1963)

## LAKE CHAMPLAIN, AT ROUSES POINT, N.Y.

Alltime high (1827-1980): 102.1 (1869). Alltime low (1939-1980): 92.17 (1941).	June 29, 1981	June 30, 1980	June		
			Average, 1939-78	Max. daily (year)	Min. daily (year)
Elevation in feet above NGVD:	95.98	95.04	96.91	101.02 (1947)	94.35 (1965)

## FLORIDA

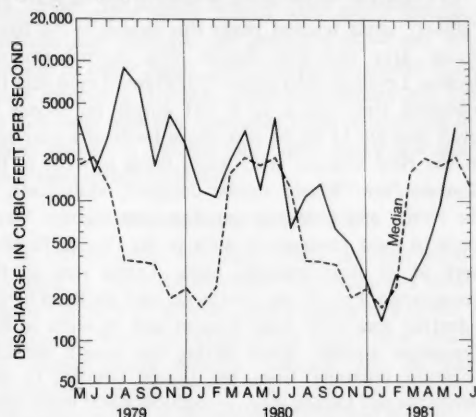
Site	June 1981		May 1981	June 1980
	Discharge in cfs	Percent of normal	Discharge in cfs	Discharge in cfs
Silver Springs near Ocala (northern Florida) .....	650	85	710	770
Miami Canal at Miami (southeastern Florida) .....	4	1	0	0
Tamiami Canal outlets, 40-mile bend to Monroe .....	9	11	0	126

(Continued from page 9.)

(November 1980 through April 1981) and was less than median in each of the past 11 months, mean flow was 325 percent of median and was in the above-normal range for the first month since August 1979.

In south-central Missouri, where monthly mean discharge of Gasconade River at Jerome was greater than median in May for the first time in 13 months, and was below the normal range in 10 of the 12 months between May 1980 and April 1981, mean flow increased sharply in June as a result of runoff from rains near monthend, was 410 percent of median, and was above the normal range for the first time since August 1979. Minor flooding occurred along many streams in this part of the State. In the northwestern part of the State, monthly mean flow of Grand River near Gallatin decreased sharply and was below the normal range for the 3d time in the past 5 months. Cumulative runoff at this site for the first 9 months of the 1981 water year was only 32 percent of median.

In north-central Iowa, rapid runoff from as much as 8½ inches of rain early in the month resulted in flooding along Winnebago, Boone, Iowa, and Des Moines Rivers. Mean flow of Des Moines River at Fort Dodge increased sharply and was in the normal range, following 3 consecutive months of flow in the below-normal range. (See graph.) In eastern Iowa, where mean flow of



Monthly mean discharge of Des Moines River at Ft. Dodge, Iowa  
(Drainage area, 4,190 sq mi; 10,852 sq km)

Cedar River at Cedar Rapids was below median in March, April, and May, flow increased sharply and was 139 percent of median as a result of increased runoff from rain late in the month. In southwestern Iowa, monthly mean discharge of Nishnabotna River above Hamburg decreased, contrary to the normal seasonal pattern, remained in the below-normal range for the 4th consecutive month, and was only 20 percent of

median. Cumulative runoff at this site for the first 9 months of the 1981 water year was only 30 percent of median.

In central South Dakota, mean flow of Bad River near Fort Pierre increased seasonally but was only 1 percent of median and remained below the normal range for the 4th consecutive month. Cumulative runoff at this station for the first 9 months of the 1981 water year was only 3 percent of median. In the eastern part of the State, mean discharge of Big Sioux River, as measured at Akron, Iowa, increased sharply from May and was in the normal range, following 3 consecutive months of below-normal flow. Cumulative runoff at this site for the first 9 months of the 1981 water year was only 25 percent of median.

In eastern North Dakota, monthly mean flow of Red River of the North at Grand Forks decreased seasonally, was only 24 percent of median, and remained below the normal range for the 13th time in the past 14 months. Cumulative runoff at this station for the first 9 months of the 1981 water year was only 26 percent of median. In the southwestern part of the State, mean flow of Cannonball River at Breien increased seasonally but remained below the normal range for the 4th consecutive month, was lowest for June since 1940, and was only 7 percent of median. Cumulative runoff at Breien for the first 9 months of the 1981 water year was only 11 percent of median.

In southeastern Saskatchewan, mean discharge of Qu'Appelle River near Lumsden increased, contrary to the seasonal pattern, and was 215 percent of the median flow for June, but remained within the normal range.

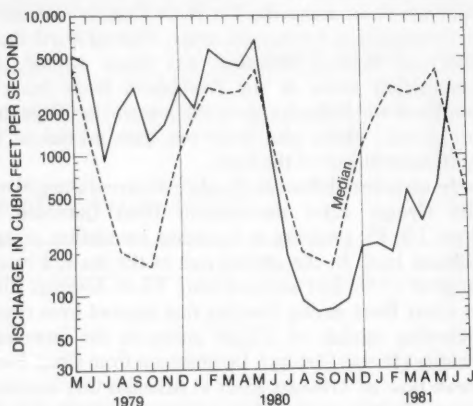
In northeastern Nebraska, mean flow of Elkhorn River at Waterloo increased seasonally but was only 29 percent of median and remained below the normal range for the 11th time in the past 12 months. In the northwestern part of the State, mean discharge of Niobrara River above the Box Butte Reservoir decreased but remained in the normal range. Flow of North Platte River, in western Nebraska, was below normal, and unregulated flows in the Republican River basin in southwestern Nebraska were 40 percent to 80 percent of normal. Flows also were less than normal in the north-central part of the State.

In east-central Kansas, flooding occurred along Marais des Cynges River downstream from Quenemo on June 10–15, resulting in extensive inundation of agricultural land. In the central part of the State, a record stage of 17.88 feet occurred June 15 on Arkansas River at Great Bend during flooding that resulted from runoff following rainfall of 17–18 inches in the immediate vicinity (Barton County). Downstream from Great Bend, mean flow of Arkansas River at Arkansas City increased seasonally but was less than median and remained in the normal range. Cumulative runoff at this site for the first 9 months of the 1981 water year was only 31 percent of median. In northeastern Kansas, mean flow of Little

Blue River near Barnes decreased, contrary to the normal seasonal pattern, was only 18 percent of median, and was below the normal range for the 11th time in the past 12 months. In the northwestern part of the State, mean flow of Saline River near Russell decreased, contrary to the seasonal pattern, was only 13 percent of median, and remained below the normal range for the 9th consecutive month.

In Oklahoma, isolated heavy rains occurred in most parts of the State, resulting in bankfull stages on several streams. In the southwestern part of the State, mean flow of Washita River near Durwood increased, contrary to the normal seasonal pattern, was 122 percent of median, but remained in the normal range. Cumulative runoff at this station for the first 9 months of the 1981 water year was only 49 percent of median. In north-eastern Oklahoma, mean discharge of Illinois River near Tahlequah was 91 percent of the median flow for June.

In central Texas, major flooding was reported June 15 in Hays, Williamson, and Travis Counties, where more than 15 inches of precipitation was reported to have fallen since June 1. In south-central Texas, the monthly mean discharge of 7,000 cfs in Guadalupe River near Spring Branch (drainage area, 1,315 square miles) was highest for June since records began in 1922. In the north-central part of the State, mean flow of North Bosque River near Clifton increased sharply into the above-normal range from the below-normal range in May, and was 468 percent of median. Mean flow at this station was below the normal range in 5 of the first 9 months of the 1981 water year, and cumulative runoff during that 9-month period was only 34 percent of median. In eastern Texas, mean discharge of Neches River near Rockland also increased sharply and was in the normal range, following 7 consecutive months of mean flow in the below-normal range. (See graph.) In the northern part of the panhandle, mean



Monthly mean discharge of Neches River near Rockland, Texas  
(Drainage area, 3,636 sq mi; 9,417 sq km)

flows during June were reported to have been below the normal range. Monthend records for 38 reservoirs in the State showed that storage increased in 28, decreased in 9, and remained the same in 1.

#### GROUND-WATER CONDITIONS

In Arkansas, the ground-water level in the deep Sparta Sand aquifer fell 42 feet, and was about 28 feet below the average for June. In the industrial Sparta Sand aquifer of central and southern Arkansas, the level in the key well at Pine Bluff fell 1 foot from last month and was about 39 feet below average. The level at the Eldorado well fell about 1 foot from last month, and was 9 feet below average.

In Iowa, the ground-water levels in key wells rose 1.2 feet at Harcourt and 0.1 foot at Marion, but remained slightly below average. Levels rose in many other areas, and several scattered areas had above-average readings.

In Kansas, levels fell in key wells in Sedgwick, Harvey, and Thomas Counties, and rose in Douglas County, and continued below average. The levels in the key wells in Harvey County and at the Kansas Agricultural Experiment Station in Thomas County reached new lows for the month of June in 41 years and 34 years of record, respectively.

In Louisiana, water levels in wells in the "400-ft" and "600-ft" sands reached peaks this month in the Baton Rouge area and have begun their normal seasonal decline. Levels in wells in the "2,000-foot" sand near the industrial area rose 2 to 3 feet during the month to levels that are 11 to 24 feet above levels of a year ago. In the New Orleans area, water levels in wells in the Gonzales-New Orleans aquifer declined, while levels in the Norco and Gramercy aquifers rose slightly. Water levels in most observation wells in the Florida Parishes were at or near seasonal highs. Levels rose in the rice-growing area of the southwest and declined in the industrial area near Lake Charles and in wells in the Evangeline aquifer. Rains during the month reduced irrigation pumping from the Chicot aquifer. In the Opelousas and Eunice areas, record-low water levels were recorded for wells in the Evangeline aquifer. The levels were 0.65 and 2.87 feet, respectively, below previous lows for June. In northern Louisiana, water levels in wells in the Sparta Sand and Miocene aquifers continued to decline. Levels in wells in the terrace and alluvial aquifers are slightly below normal seasonal levels.

In Nebraska, ground-water levels fell slightly in key wells, and remained below long-term averages at month-end.

In North Dakota, ground-water levels continued to be below normal in most areas of the State. Ground-water

level in the key well in Stark County reached a new monthly low in 13 years of record.

In Texas, ground-water levels in key wells rose at Austin and San Antonio, but declined at Houston and El Paso. Water levels were above average in the Edwards aquifer at Austin and San Antonio, but below average in the Evangeline aquifer at Houston and in the bolson deposits at El Paso. Water levels at El Paso reached a new alltime low in 16 years of record.

## WEST

[Alberta and British Columbia; Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming]

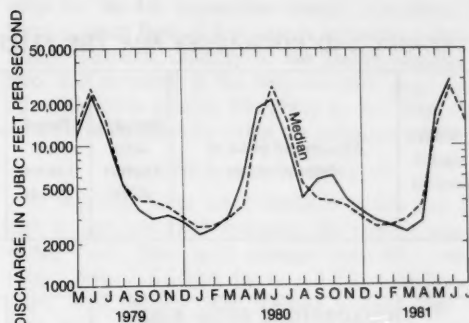
*Streamflow generally decreased seasonally in Arizona and California, increased in Alberta, Idaho, Nevada, and Wyoming, and was variable elsewhere in the region. Monthly mean flows remained below the normal range in parts of Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming, and decreased into that range in parts of Alberta, British Columbia, and Montana. Monthly mean discharges remained in the above-normal range in parts of Washington and increased into that range in parts of Arizona and Oregon. Flooding occurred in Wyoming.*

*Ground-water levels declined in Utah; trends were mixed in other States. Levels were below average in Arizona and Montana, and generally above and below average in other States. New lows for the month of June were reached in Arizona, Idaho, New Mexico, and Utah. A new June high was reached in Utah. New alltime lows were reached in Arizona and Idaho, and a new alltime high was reached in Nevada.*

### STREAMFLOW CONDITIONS

In northwestern Wyoming, severe flooding occurred on June 9, 10 in the Shoshone River basin as a result of rapid runoff from intense rainfall falling on a recent wet snowpack. Record-breaking flood events were observed at several gaging stations. Selected data on stages, discharges, gaging station locations, and recurrence intervals are given in the accompanying map and table. By contrast, in southern Wyoming, monthly mean discharge of North Platte River above Seminoe Reservoir, near Sinclair increased seasonally to 45 percent of median but remained in the below-normal range for the 4th consecutive month.

In southern Montana, monthly mean discharge of Yellowstone River at Billings increased sharply but was only 111 percent of median and was within the normal range. (See graph.) In the northwestern part of the State, mean flow of Marias River near Shelby decreased



Monthly mean discharge of Yellowstone River at Billings, Mont. (Drainage area, 11,795 sq mi; 30,549 sq km)

seasonally, was only 82 percent of median, and was below the normal range for the first time since July 1980. Elsewhere in the State, mean flows at index stations were near or slightly above median but within the normal range.

In southwestern Alberta, where monthly mean discharge of Bow River at Banff was above the normal range and 176 percent of median in May, flow increased seasonally but was only 76 percent of median during June and was below the normal range.

In southern British Columbia, monthly mean flow of Fraser River at Hope increased seasonally but was only 88 percent of median and was below the normal range for the first time since August 1980. Elsewhere in the Province, mean flows were generally below median but within the normal range.

In Idaho, streamflow increased at all index stations and was within the normal range throughout the State. Reservoir storage for irrigation was above average, while contents of reservoirs in northern Idaho used for power were near average.

In the Chehalis River basin in southwestern Washington, monthly mean flow at the index station near Grand Mound decreased seasonally, but remained in the above-normal range for the 2d consecutive month and was 142 percent of median. Elsewhere in the State, streamflow was near median and in the normal range except for Wenatchee River at Peshastin and Klickitat River near Pitt, drainages located on the eastern slope of the Cascade Range, which indicated flows in the below-normal range. Storage in all five index reservoirs was near average.

In north-coastal Oregon, monthly mean discharge in Wilson River near Tillamook increased, contrary to the seasonal pattern, was nearly 3 times median, and was above the normal range. In the western part of the State, mean flow of Willamette River at Salem also increased contrary to the normal seasonal pattern, and was above

## STAGES AND DISCHARGES FOR THE FLOODS OF JUNE 1981 AT SELECTED SITES IN WYOMING

WRD station number	Stream and place of determination	Drainage area (square miles)	Period of known floods	Maximum flood previously known			Maximum during present flood				
				Date	Stage (feet)	Dis- charge (cfs)	Date	Stage (feet)	Discharge		Recur- rence interval (years)
									Cfs	Cfs per square mile	
WYOMING											
YELLOWSTONE RIVER BASIN											
06280000	North Fork Shoshone River near Wapiti . . . . .	775	1921-26, 1979-	June 23, 1925	<sup>a</sup> 6.88	9,250	June 9	12.0	21,000	27.1	>100
06280300	South Fork Shoshone River near Valley . . . . .	297	1956-58, 1959-	June 15, 1963	8.83	8,220	9	9.5	11,000	37.0	>100
06281000	South Fork Shoshone River above Buffalo Bill Reservoir . . . . .	585	1903, 1905-08 1921-26, 1973-	July 3, 1975	5.92	8,120	9	9.8	13,500	23.1	>100
06282000	Shoshone River below Buffalo Bill Reservoir . .	1,538	1909-	June 15, 1918	....	18,700	9	11.57	16,600	10.8	50
06285100	Shoshone River near Lovell . . . . .	2,350	1966-	July 1, 1967	7.49	13,400	10	7.94	15,200	6.5	50

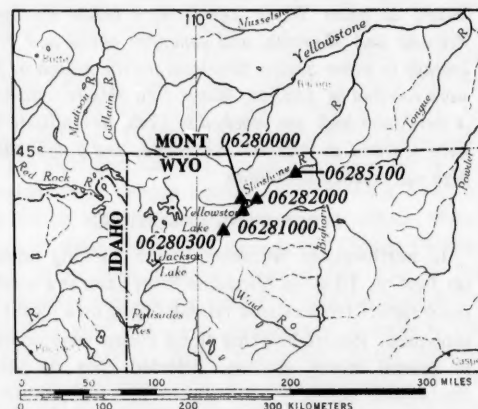
<sup>a</sup>At former site and datum.

the normal range at 175 percent of median. By contrast, in northeastern Oregon, monthly mean discharge of John Day River at Service Creek decreased seasonally but was above the normal range for the first time since September 1980. Elsewhere in the State, flows were in the normal range.

In north-coastal California, mean flow in Smith River near Crescent City decreased seasonally, but was within the normal range following 3 consecutive months of flow in the below-normal range. Flows at all other index streams in the State were in the below-normal range except Arroyo Seco near Pasadena in southern California, which was within the normal range. Combined contents of 10 index reservoirs in northern and central California were 100 percent of average and 89 percent of the contents one year ago.

In northeastern Nevada, flow of Humboldt River at Palisade increased seasonally but was only 20 percent of median and remained in the below-normal range for the 4th consecutive month. Cumulative runoff for the first 9 months of the 1981 water year was only 37 percent of median at that site.

In Utah, streamflow increased in some basins and decreased in others but was below median throughout the State. In the northwestern part of the State, mean

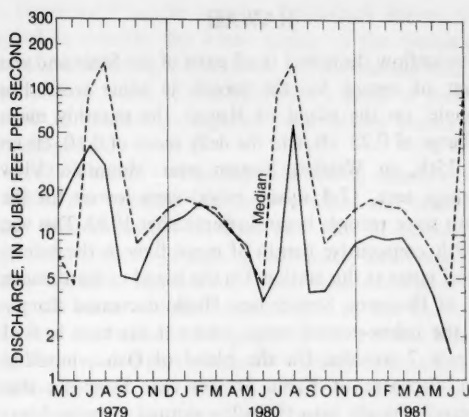


Location of stream-gaging stations in Wyoming, described in table of peak stages and discharges.

flow of Big Cottonwood Creek near Salt Lake City remained the same as last month and continued in the below-normal range. In the eastern part of the State, monthly mean discharge of Green River at Green River and Colorado River near Cisco increased seasonally to 56 and 37 percent of median, respectively, and remained in the below-normal range for 4 and 5 consecutive months

at the respective sites. Elsewhere in the State, flows were within the normal range.

In southern Arizona, monthly mean flow of San Pedro River at Charleston continued to decrease seasonally, was about one-third the median flow for June, and remained in the below-normal range for the 12th consecutive month. (See graph.) In the central part



Monthly mean discharge of San Pedro River at Charleston, Ariz. (Drainage area, 1,219 sq mi; 3,157 sq km)

of the State, by contrast, mean flow of Verde River below Tangle Creek, above Horseshoe Dam decreased seasonally but was above the normal range for the first time since October 1980. Elsewhere in the State, mean flows decreased seasonally but were within the normal range.

Contents of the Colorado River Storage Project increased 726,920 acre feet during the month.

East of the Continental Divide in central Colorado, mean flow of Bear Creek at Morrison increased seasonally but remained in the below-normal range for the 3d consecutive month. Also in central Colorado, but west of the Divide, mean flow in Roaring Fork River at Glenwood Springs increased seasonally to 69 percent of median but remained in the below-normal range for the 5th time in the past 6 months. In the northwestern part of the State, monthly mean flow of Yampa River at Steamboat Springs decreased to only 50 percent of median and remained in the below-normal range.

In southwestern New Mexico, where monthly mean discharge of Gila River near Gila was within the normal range in April and May, flow decreased sharply to  $\frac{1}{2}$  the median flow for June and was below the normal range. In the north-central part of the State, mean flow of Pecos River near Pecos decreased seasonally to only 26 percent of median and remained in the below-normal

range for the 4th consecutive month. In northern New Mexico, mean flow of Rio Grande below Taos Junction Bridge increased, contrary to the normal seasonal pattern, but remained in the below-normal range for the 3d consecutive month. Elsewhere in the State, flows were below median but within the normal range.

#### GROUND-WATER CONDITIONS

In Arizona, water levels declined in two key wells, rose in one well, and remained the same in one well during June. Water-level changes from May readings ranged from a 0.2-foot rise to a 3.2-foot decline. The water level in one well reached a new June low. Two wells reached new alltime lows, and one well equaled the alltime low.

In southern California, water levels rose in the key well near Lompoc but fell in all others. The levels in the three wells in Santa Barbara County remained above average, while levels in the wells in Los Angeles and Orange Counties were below average.

In Idaho, the ground-water level in the key well penetrating the sand and gravel aquifer in the Boise Valley rose and was above average. Water levels in the key wells representative of the Snake Plain aquifer near Atomic City and Eden reached new lows for the month of June in 24 years and 32 years of record, respectively. A new alltime low in 31 years of record was reached in a key well near Rupert. Levels were slightly above average in the Snake Plain aquifer near Meridian, but were below average elsewhere. Water levels representative of the alluvium aquifer underlying the Rathdrum Prairie in northern Idaho were below average.

In Montana, levels in the key water-table wells rose 4.2 feet at Missoula and 5.6 feet at Hamilton, but continued to be slightly below average at both localities.

In Nevada, the levels in the key wells in Las Vegas and Paradise Valleys fell, but rose slightly in the key well in Steptoe Valley. Levels were below average in Las Vegas Valley, but above average in Paradise and Steptoe Valleys. Water levels in Steptoe Valley reached a new alltime high in 31 years of record.

In New Mexico, ground-water levels rose slightly in the key well at Dayton, but fell in other key wells from 0.2 foot at Lovington to 10.2 feet at Berrendo-Smith. Water levels were slightly above average at Berrendo-Smith, but below average elsewhere. The key well at Dayton set a new low for the month of June in 43 years of record.

In Utah, ground-water levels fell in all key wells in the Blanding, Flowell, Logan, and Holladay areas. Declines ranged from 0.34 foot at Blanding to 10.81 feet at Holladay. Levels near Flowell were 19 feet below average, and at Holladay were 20 feet below average. Levels were above average in the Blanding and Logan areas. Levels at Blanding reached a new high for the month of June in 21 years of record, and levels at Holladay reached a new monthly low in 34 years of record.

In Washington, the artesian ground-water level in the key well in Spokane Valley, in the eastern part of the State, rose but was about 4.7 feet below average. Water level in the key well at Tacoma, in western Washington, fell slightly, but was more than 6 feet above average.

## ALASKA

Streamflow increased seasonally at all index stations in the State, except in Gold Creek at Juneau, where monthly mean flow decreased, contrary to the normal seasonal pattern, and was below the normal range for the first time since July 1980. In south-central Alaska, mean flow increased seasonally in Little Susitna River near Palmer (drainage area, 61.9 square miles), but the monthly mean discharge of 283 cfs was lowest for June since records began in 1948, and was below the normal range for the first time since May 1980. In the east-central part of the State, mean flow of Tanana River at Nenana increased seasonally but remained in the below-normal range. In the adjacent basin of Chena River, monthly mean discharge of Chena River at Fairbanks increased, contrary to the normal seasonal pattern, as a result of runoff from rains in the headwaters area near monthend, and was in the normal range. In the south-coastal part of the State, monthly mean flow of Kenai River at Cooper Landing increased seasonally as a result of snowmelt runoff, and remained in the above-normal range for the 8th time in the past 9 months. Cumulative runoff at this station was 183 percent of median for the first 9 months of the 1981 water year.

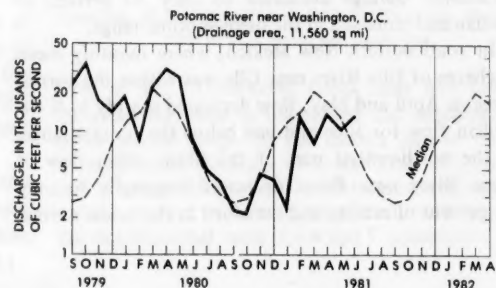
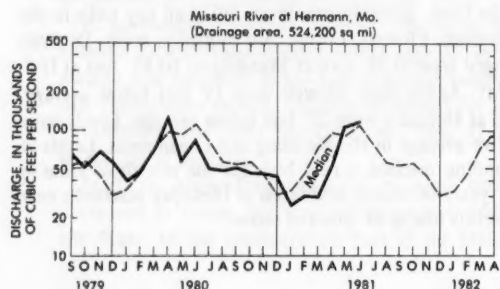
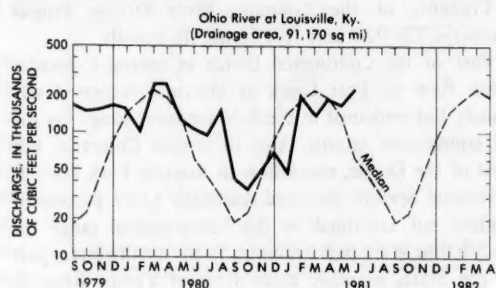
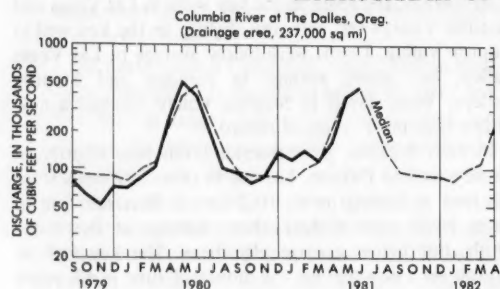
Ground-water levels in the confined aquifer system in the Anchorage area declined from last month. The declines were generally from 0.5 foot to 4 feet, with several areas dropping as much as 7 feet below last month's level.

## HAWAII

Streamflow decreased in all parts of the State and was lowest of record for the month in some areas. For example, on the island of Hawaii, the monthly mean discharge of 0.23 cfs, and the daily mean of 0.10 cfs on the 25th, in Waiakea Stream near Mountain View (drainage area, 17.4 square miles) were lowest for the month since records began in September 1930. This was the 7th consecutive month of mean flow in the below-normal range at this station. On the island of Maui, mean flow of Honopou Stream near Huelo decreased sharply into the below-normal range, where it has been in 6 of the past 7 months. On the island of Oahu, monthly mean discharge of Kalihi Stream near Honolulu also decreased sharply into the below-normal range and was only 51 percent of median. On the island of Kauai, mean flow of East Branch of North Fork Wailua River near Lihue also decreased but remained in the normal range.

On Guam, Mariana Islands, monthly mean flow of Ylig River near Yona increased and was 193 percent of median, but remained in the normal range for the 9th consecutive month.

## HYDROGRAPHS OF FOUR LARGE RIVERS



## DISSOLVED SOLIDS AND WATER TEMPERATURES FOR JUNE ON SIX LARGE RIVERS

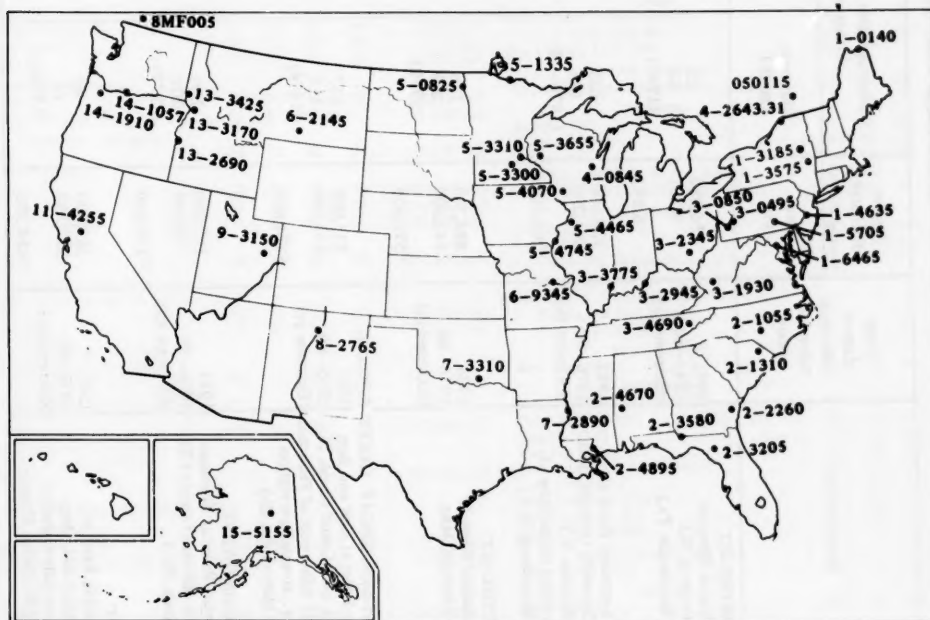
The table on page 18 shows dissolved-solids and temperature data for June at six stream-sampling sites that are part of the National Stream Quality Accounting Network (NASQAN). NASQAN, as established by the U.S. Department of the Interior, Geological Survey, is designed to describe the water quality of the Nation's streams and rivers on a systematic and continuing basis, so as to meet many of the information needs of those involved in national or regional water-quality planning and management.

"Dissolved solids," as described in several columns of the table, are minerals dissolved in water and usually consist predominantly of silica and ions of calcium, magnesium, sodium, potassium, carbonate, bicarbonate, sulfate, chloride, and nitrate. These same minerals are among the most common components of the Earth's solid rocks and minerals, but gradually erode and at least partly dissolve as a part of natural weathering processes. Collectively these and other dissolved minerals constitute the dissolved-solids concentration expressed in

milligrams per liter (mg/L) or the generally equivalent expression, parts per million (parts of dissolved matter in one million parts of water, by weight). Values of dissolved solids are convenient for comparing the quality of water from one time to another and from one place to another. Most drinking water contains between 50 and 500 mg/L of dissolved solids.

"Dissolved-solids discharge," expressed in tons per day, represents the total daily amount of dissolved minerals carried by the stream and is calculated by multiplying the dissolved-solids concentration (in mg/L) by the stream discharge (in cfs; times a unit conversion factor of .0027). Even though dissolved-solids *concentrations* are generally higher during periods of low streamflow than of high streamflow, the highest dissolved-solids *discharges* occur during periods of high streamflow because the total quantities of water, and therefore total load of dissolved minerals, are so much greater than at times of low flow.

### SELECTED STREAM-GAGING STATIONS ON LARGE RIVERS



Location of stream-gaging stations on large rivers listed in table on page 20.

## DISSOLVED SOLIDS AND WATER TEMPERATURES FOR JUNE AT DOWNSTREAM SITES ON SIX LARGE RIVERS

Station number	Station name	June data of following calendar years	Stream discharge during month <sup>c</sup>	Dissolved-solids concentration during month <sup>a</sup>		Dissolved-solids discharge during month <sup>a</sup>			Water temperature during month <sup>b</sup>	
				Minimum (mg/L)	Maximum (mg/L)	Mean	Minimum (tons per day)	Maximum	Mean, in °C	Maximum, in °C
01463500	NORTHEAST Delaware River at Trenton, N.J. (Morrisville, Pa.)	1981 1945-80 (Extreme yr)	*6,880 9,397 c6,992	85 60 (1945)	122 143 (1965)	2,060 .....	1,450 495 (1965)	3,140 22,100 (1973)	23.5 .....	20.0 13.5
04264331	St. Lawrence River at Cornwall, Ontario, near Massena, N.Y. median streamflow at Ogdensburg, N.Y.	1981 1976-80 (Extreme yr)	338,000 301,200 c261,500	165 166 (1976-78)	171 169 (1976)	153,000 134,000	112,000 110,000 (1977)	250,000 139,000 (1976)	16.5 15.0	14.0 11.5
07289000	SOUTHEAST Mississippi River at Vicksburg, Miss.	1981 1976-80 (Extreme yr)	884,700 542,500 c591,400	176 209 (1979)	204 316 (1976)	435,000 256,000	419,000 34,400 (1978)	516,000 579,000 (1979)	25.5 25.0	20.5 17.0
03612500	WESTERN GREAT LAKES REGION Ohio River at lock and dam 53, near Grand Chain, Ill. (25 miles west of Paducah, Ky.; streamflow station at Metropolis, Ill.)	1981 1955-80 (Extreme yr)	525,000 203,900 c174,600	157 111 (1974)	199 300 (1970)	.....	84,000 27,000 (1977)	396,000 328,000 (1968)	.....	19.0 16.5
06934500	MIDCONTINENT Missouri River at Hermann, Mo. (60 miles west of St. Louis, Mo.)	1981 1976-80 (Extreme yr)	117,000 83,000 c109,600	250 207 (1977)	436 448 (1980)	107,000 74,900	79,000 44,000 (1977)	165,000 143,000 (1980)	24.0 25.0	20.5 21.0
14128910	WEST Columbia River at Warrendale, Oreg. (streamflow station at The Dalles, Oreg.)	1981 1976-80 (Extreme yr)	367,000 222,200 c454,200	80 61 (1976)	91 107 (1977)	82,200 46,500	59,200 19,100 (1977)	97,900 76,800 (1980)	15.0 16.0	14.0 12.5

<sup>a</sup> Dissolved-solids concentrations when not analyzed directly, are calculated on basis of measurements of specific conductance.

<sup>b</sup> To convert °C to °F:  $(1.8 \times ^\circ\text{C}) + 32 = ^\circ\text{F}$ .

<sup>c</sup> Median of monthly values for 30-year reference period, water years 1941-70, for comparison with data for current month.

\* Dissolved-solids and water-temperature records not available June 25-30.

Principal uses: F—Flood control I—Irrigation M—Municipal P—Power R—Recreation W—Industrial	Reservoir	End of May 1981	End of June 1981	End of June 1980	Average for end of June	Normal maximum	Principal uses: F—Flood control I—Irrigation M—Municipal P—Power R—Recreation W—Industrial	Reservoir	End of May 1981	End of June 1981	End of June 1980	Average for end of June	Normal maximum								
		Percent of normal maximum							Percent of normal maximum												
<b>NORTHEAST REGION</b>							<b>MIDCONTINENT REGION—Continued</b>														
<b>NOVA SCOTIA</b>							<b>SOUTH DAKOTA—Continued</b>														
Rossignol, Mulgrave, Falls Lake, St. Margaret's Bay, Black, and Ponhook Reservoirs (P)	80	72	65	71	226,300 (a)		Lake Sharpe (FIP)	101	99	102	100	1,725,000 ac-ft									
							Lewis and Clarke Lake (FIP)	78	81	82	88	477,000 ac-ft									
<b>QUEBEC</b>							<b>NEBRASKA</b>														
Allard (P)	91	96	88	82	280,600 ac-ft		Lake McConaughy (IP)	86	84	92	80	1,948,000 ac-ft									
Gouin (P)	98	90	72	64	6,954,000 ac-ft		<b>OKLAHOMA</b>														
<b>MAINE</b>							Eufaula (FPR)	83	95	103	95	2,378,000 ac-ft									
Seven reservoir systems (MP)	87	85	66	87	178,500 mcf		Keystone (FPR)	96	98	132	105	661,000 ac-ft									
<b>NEW HAMPSHIRE</b>							Tenkiller Ferry (FPR)	104	106	103	101	628,200 ac-ft									
First Connecticut Lake (P)	90	94	92	90	3,330 mcf		Lake Altus (FIMR)	23	26	94	71	133,000 ac-ft									
Lake Francis (FPR)	84	90	97	87	4,326 mcf		Lake O'The Cherokees (FPR)	86	98	96	96	1,492,000 ac-ft									
Lake Winnepesaukee (PR)	102	102	94	96	7,220 mcf		<b>OKLAHOMA—TEXAS</b>														
<b>VERMONT</b>							Lake Texoma (FMPRW)	99	99	98	101	2,722,000 ac-ft									
Harriman (P)	64	72	79	83	5,060 mcf		<b>TEXAS</b>														
Somerset (P)	85	73	80	86	2,500 mcf		Bridgeport (IMW)	38	43	26	52	386,400 ac-ft									
<b>MASSACHUSETTS</b>							Canyon (FMR)	96	113	92	78	385,600 ac-ft									
Cobble Mountain and Borden Brook (MP)	88	84	84	88	3,394 mcf		International Amistad (FIMPW)	100	99	84	79	3,497,000 ac-ft									
<b>NEW YORK</b>							International Falcon (FIMPW)	102	104	63	66	2,668,000 ac-ft									
Great Sacandaga Lake (FPR)	98	97	93	92	34,270 mcf		Livingston (IMW)	100	101	96	86	1,788,000 ac-ft									
Indian Lake (FMP)	94	95	97	101	4,500 mcf		Possom Kingdom (IMPRW)	96	98	96	99	570,200 ac-ft									
New York City reservoir system (MW)	85	83	90		547,500 mg		Toledo Bend (P)	23	20	20	27	307,000 ac-ft									
<b>NEW JERSEY</b>							Red Bluff (PI)	86	99	97	91	4,472,000 ac-ft									
Wanaque (M)	100	90	88	89	27,730 mg		Twin Buttes (FIM)	50	53	39	29	1,777,800 ac-ft									
<b>PENNSYLVANIA</b>							Lake Kemp (IMW)	53	75	62	94	1,680,000 ac-ft									
Allegheny (FPR)	47	49	49	49	51,400 mcf		Lake Meredith (FMW)	16	16	27	38	821,300 ac-ft									
Pymatuning (FMR)	99	97	101	97	8,191 mcf		Lake Travis (FIMPW)	97	107	88	81	1,144,000 ac-ft									
Raystown Lake (FR)	59	61	68	60	33,190 mcf		<b>THE WEST</b>														
Lake Wallenpaupack (PR)	79	85	81	86	6,875 mcf		<b>WASHINGTON</b>														

<sup>a</sup>Thousands of kilowatt-hours (the potential electric power that could be generated by the volume of water in storage).

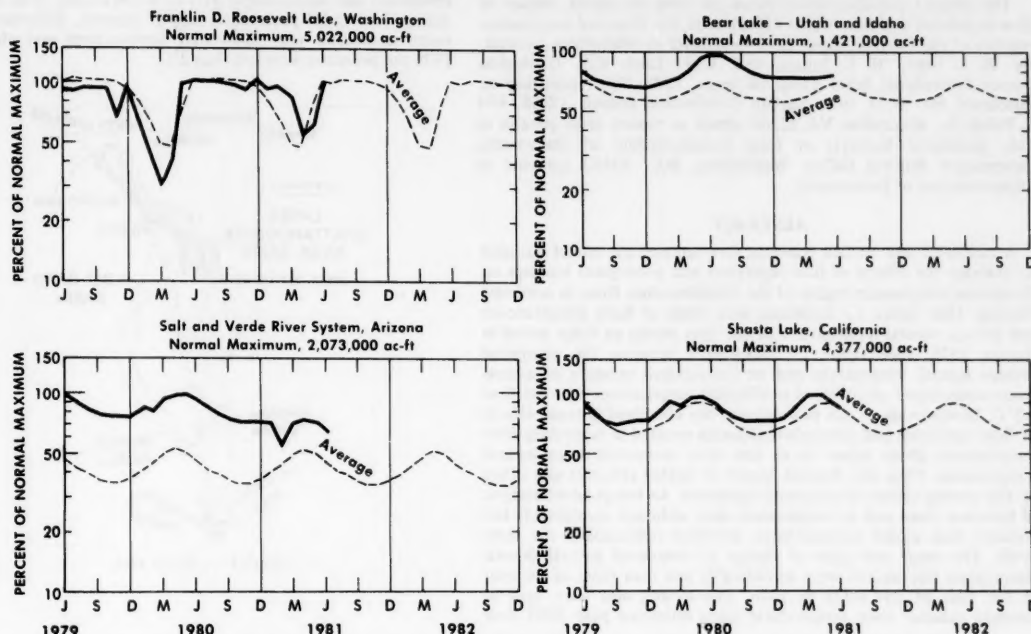
## FLOW OF LARGE RIVERS DURING JUNE 1981

Station number*	Stream and place of determination	Drainage area (square miles)	Mean annual discharge through September 1975 (cfs)	June 1981					
				Monthly discharge (cfs)	Percent of median monthly discharge, 1941-70	Charge in discharge from previous month (percent)	Discharge near end of month		
							(cfs)	(mgd)	Date
1-0140	St. John River below Fish River at Fort Kent, Maine .....	5,690	9,549	10,418	111	-42	18,500	11,960	29
1-3185	Hudson River at Hadley, N.Y. ....	1,664	2,853	1,300	56	-60	1,500	970	30
1-3575	Mohawk River at Cohoes, N.Y. ....	3,456	5,63	2,240	73	-36	1,500	970	30
1-4635	Delaware River at Trenton, N.J. ....	6,780	11,630	6,884	98	-61	5,030	3,250	29
1-5705	Susquehanna River at Harrisburg, Pa. ....	24,100	34,200	27,400	119	-31	15,900	10,300	29
1-6465	Potomac River near Washington, D.C. ....	11,560	11,190	13,380	181	+27	5,600	3,620	30
2-1055	Cape Fear River at William O. Huske Lock near Tarheel, N.C. ....	4,810	5,007	1,159	60	-4	570	370	30
2-1310	Pee Dee River at Pee Dee, S.C. ....	8,830	9,657	5,390	91	+143	3,880	2,510	26
2-2260	Altamaha River at Doctortown, Ga. ....	13,600	13,780	3,944	46	-9	2,630	1,700	30
2-3205	Suwannee River at Branford, Fla. ....	7,880	6,970	2,480	50	-27	2,260	1,460	30
2-3580	Apalachicola River at Chattahoochee, Fla. ....	17,200	22,330	9,140	56	-21	9,140	5,910	30
2-4670	Tombigbee River at Demopolis lock and dam near Coatopa, Ala. ....	15,400	22,570	7,777	121	+45	2,100	1,360	29
2-4895	Pearl River near Bogalusa, La. ....	6,630	9,263	3,207	90	-18	2,220	1,435	30
3-0495	Allegheny River at Natrona, Pa. ....	11,410	19,210	24,020	211	-12	16,700	10,800	25
3-0850	Monongahela River at Braddock, Pa. ....	7,337	12,360	33,190	526	+119	15,600	10,080	25
3-1930	Kanawha River at Kanawha Falls, W. Va. ....	8,367	12,530	19,300	287	+19	6,710	4,340	23
3-2345	Scioto River at Higby, Ohio. ....	5,131	4,513	14,650	718	+45	4,630	2,990	29
3-2945	Ohio River at Louisville, Ky. <sup>2</sup> ....	91,170	114,100	226,600	370	+32	134,700	87,100	25
3-3775	Wabash River at Mount Carmel, Ill. ....	28,635	27,030	54,580	257	-25	34,500	22,300	29
3-4690	French Broad River below Douglas Dam, Tenn. ....	4,543	6,794	8,167	175	+81	.....	.....	...
4-0845	Fox River at Rapide Croche Dam, near Wrightstown, Wis. <sup>3</sup> ....	6,150	4,185	2,203	58	-38	.....	.....	...
02MC002	St. Lawrence River at Cornwall, Ontario—near Massena, N.Y. <sup>3</sup> ....	299,000	241,100	252,900	97	+2	258,000	166,700	30
(4-2643,31)	St. Maurice River at Grand Mere, Quebec. ....	16,300	25,300	32,600	108	-54	32,900	21,300	30
5-0825	Red River of the North at Grand Forks, N. Dak. ....	30,100	7,524	1,066	24	-23	1,000	650	30
5-1335	Rainy River at Manitou Rapids, Minn. ....	19,400	12,950	21,400	103	+34	26,100	16,900	28
5-3300	Minnesota River near Jordan, Minn. ....	16,200	3,412	4,285	78	+89	11,500	7,430	29
5-3310	Mississippi River at St. Paul, Minn. ....	36,800	10,580	13,812	78	+25	24,800	16,000	29
5-3655	Chippewa River at Chippewa Falls, Wis. ....	5,600	5,110	9,509	170	-4	.....	.....	...
5-4070	Wisconsin River at Muscoda, Wis. ....	10,300	8,613	9,268	95	-18	13,500	8,700	26
5-4465	Rock River near Joslin, Ill. ....	9,551	5,852	7,530	137	-8	7,600	4,900	30
5-4745	Mississippi River at Keokuk, Iowa. ....	119,000	62,570	74,300	86	-8	120,700	78,000	30
6-2145	Yellowstone River at Billings, Mont. ....	11,796	6,986	29,280	111	+72	26,900	17,400	30
6-9345	Missouri River at Hermann, Mo. ....	524,200	79,750	116,700	106	+8	138,000	89,200	30
7-2890	Mississippi River at Vicksburg, Miss. <sup>4</sup> ....	1,140,500	573,600	887,100	150	+48	805,000	520,300	29
7-3310	Washita River near Durwood, Okla. ....	7,202	1,414	2,067	122	+73	180	116	30
8-2765	Rio Grande below Taos Junction Bridge, near Taos, N. Mex. ....	9,730	724	272	36	+3	226	146	25
9-3150	Green River at Green River, Utah. ....	40,600	6,366	10,457	56	+67	3,060	1,980	30
11-4255	Sacramento River at Verona, Calif. ....	21,257	19,150	7,796	73	-30	7,800	5,040	25
13-2690	Snake River at Weiser, Idaho. ....	69,200	18,170	24,040	98	+36	8,750	5,655	28
13-3170	Salmon River at White Bird, Idaho. ....	13,550	11,290	38,760	101	+29	23,360	15,100	28
13-3425	Clearwater River at Spalding, Idaho. ....	9,570	15,570	43,925	120	+43	28,180	18,200	28
14-1057	Columbia River at The Dalles, Oreg. <sup>5</sup> ....	237,000	194,600	466,900	98	+20	.....	.....	...
14-1910	Willamette River at Salem, Oreg. ....	7,280	23,810	23,500	175	+48	18,500	12,000	26-30
15-5155	Tanana River at Nenana, Alaska. ....	25,600	23,850	36,540	77	+68	.....	.....	...
8MF005	Fraser River at Hope, British Columbia. ....	83,800	96,400	217,900	88	+28	176,900	114,300	29

<sup>1</sup> Adjusted.<sup>2</sup> Records furnished by Corps of Engineers.<sup>3</sup> Records furnished by Buffalo District, Corps of Engineers, through International St. Lawrence River Board of Control. Discharges shown are considered to be the same as discharge at Ogdensburg, N.Y. when adjusted for storage in Lake St. Lawrence.<sup>4</sup> Records of daily discharge computed jointly by Corps of Engineers and Geological Survey.<sup>5</sup> Discharge determined from information furnished by Bureau of Reclamation, Corps of Engineers, and Geological Survey.

\*The U.S. station numbers as listed in this table are in a shortened form previously in use, and used here for simplicity of tabular and map presentation. The full, correct number contains 8 digits and no punctuation marks. For example, the correct form for station number 1-3185 is 01318500.

# USABLE CONTENTS OF SELECTED RESERVOIRS AND RESERVOIR SYSTEMS JUNE 1979 TO JUNE 1981



Near- or above-average contents continued to characterize most reservoirs in West during June. (See graphs above.)

## WATER RESOURCES REVIEW

June 1981

Based on reports from the Canadian and U.S. field offices; completed July 15, 1981

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### EXPLANATION OF DATA

Cover map shows generalized pattern of streamflow for June based on 20 index stream-gaging stations in Canada and 130 index stations in the United States. Alaska and Hawaii inset maps show streamflow only at the index gaging stations which are located near the points shown by the arrows.

Streamflow for June 1981 is compared with flow for June in the 30-year reference period 1941–70. Streamflow is considered to be *below the normal range* if it is within the range of the low flows that have occurred 25 percent of the time (below the lower quartile) during the reference period. Flow for June is considered to be *above the normal range* if it is within the range of the high flows that have occurred 25 percent of the time (above the upper quartile).

Flow higher than the lower quartile but lower than the upper quartile is described as being *within the normal range*. In the Water Resources Review the median is obtained by ranking the 30 flows of the reference period in their order of magnitude; the highest flow is number 1, the lowest flow is number 30, and the average of the 15th and 16th highest flows is the median.

The normal is an average (but not an arithmetic average) or middle value; half of the time you would expect the June flows to be below the median and half of the time to be above the median. Shorter reference periods are used for the Alaska index stations because of the limited records available.

Statements about *ground-water levels* refer to conditions near the end of June. Water level in each key observation well is compared with average level for the end of June determined from the entire past record for that well or from a 20-year reference period, 1951–70. *Changes in ground-water levels*, unless described otherwise, are from the end of May to the end of June.

The Water Resources Review is published monthly. Special-purpose and summary issues are also published. Issues of the Review are free on application to the Water Resources Review, U.S. Geological Survey, Reston, Virginia 22092.

# IMPACT OF FLOW REGULATION AND POWERPLANT EFFLUENTS ON THE FLOW AND TEMPERATURE REGIMES OF THE CHATTAHOOCHEE RIVER—ATLANTA TO WHITESBURG, GEORGIA

The abstract and illustrations below are from the report, *Impact of flow regulation and powerplant effluents on the flow and temperature regimes of the Chattahoochee River—Atlanta to Whitesburg, Georgia*, by R. E. Faye, H. E. Jobson, and L. F. Land: U.S. Geological Survey Professional Paper 1108, 56 pages, 1979. This report may be purchased for \$4.25 from Eastern Distribution Branch, USGS, 604 S. Picket St., Alexandria, VA 22304 (check or money order payable to U.S. Geological Survey); or from Superintendent of Documents, Government Printing Office, Washington, D.C. 20402 (payable to Superintendent of Documents).

## ABSTRACT

A calibrated and verified transient flow-temperature model was used to evaluate the effects of flow regulation and powerplant loadings on the natural temperature regime of the Chattahoochee River in northeast Georgia. (See figure 1.) Estimates were made of both instantaneous and average natural temperatures in the river during an 8-day period in August 1976. (See figure 2.) Differences between the computed average natural temperature and an independent estimate of natural temperature based on observed equilibrium temperatures were less than 0.5°C. Downstream of the powerplants, the combined thermal effects of flow regulation and powerplant effluents resulted in mean daily river temperatures about equal to or less than computed mean natural temperatures. Thus the thermal impact of heated effluents was offset by the cooling effects of structural regulation. An independent analysis of historical river- and air-temperature data, although considerably less accurate than model computations, provided substantially the same result. The range and rates of change of computed natural diurnal temperature fluctuations were considerably less than those in the river at the time of this study in 1976. The models also were used to simulate summer river temperatures using estimated year 2000 flow

conditions and meteorologic data collected during 1976. Except during periods of peak water-supply demand, differences between computed year 2000 river temperatures and observed 1976 temperatures were less than 2°C.

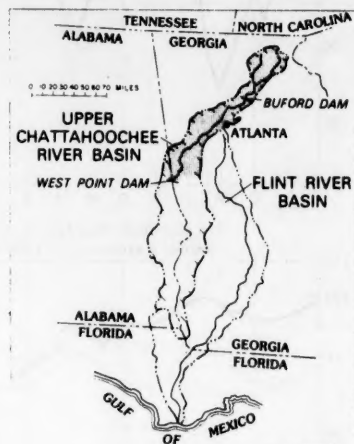


Figure 1.—Study area.

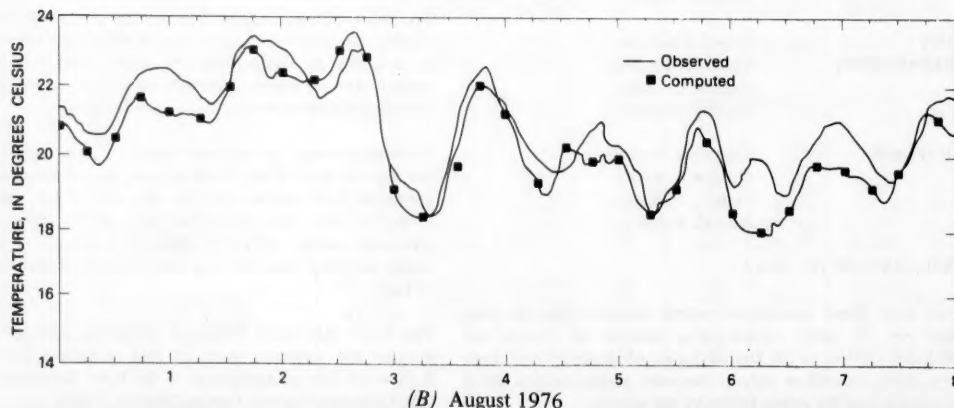
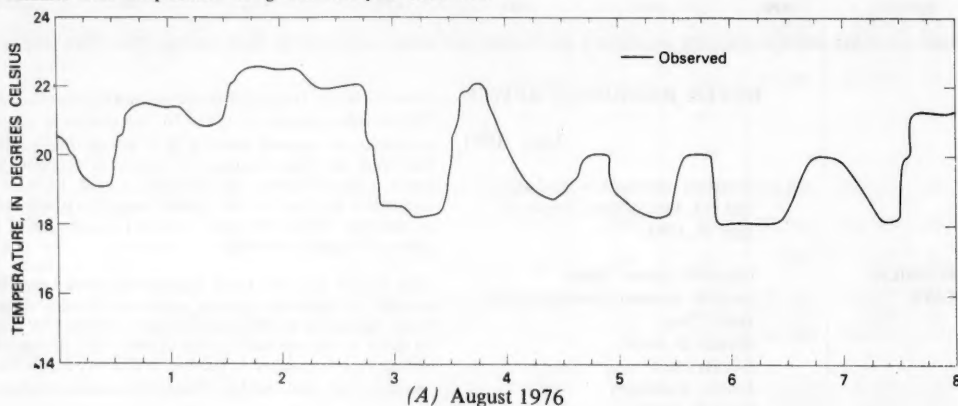
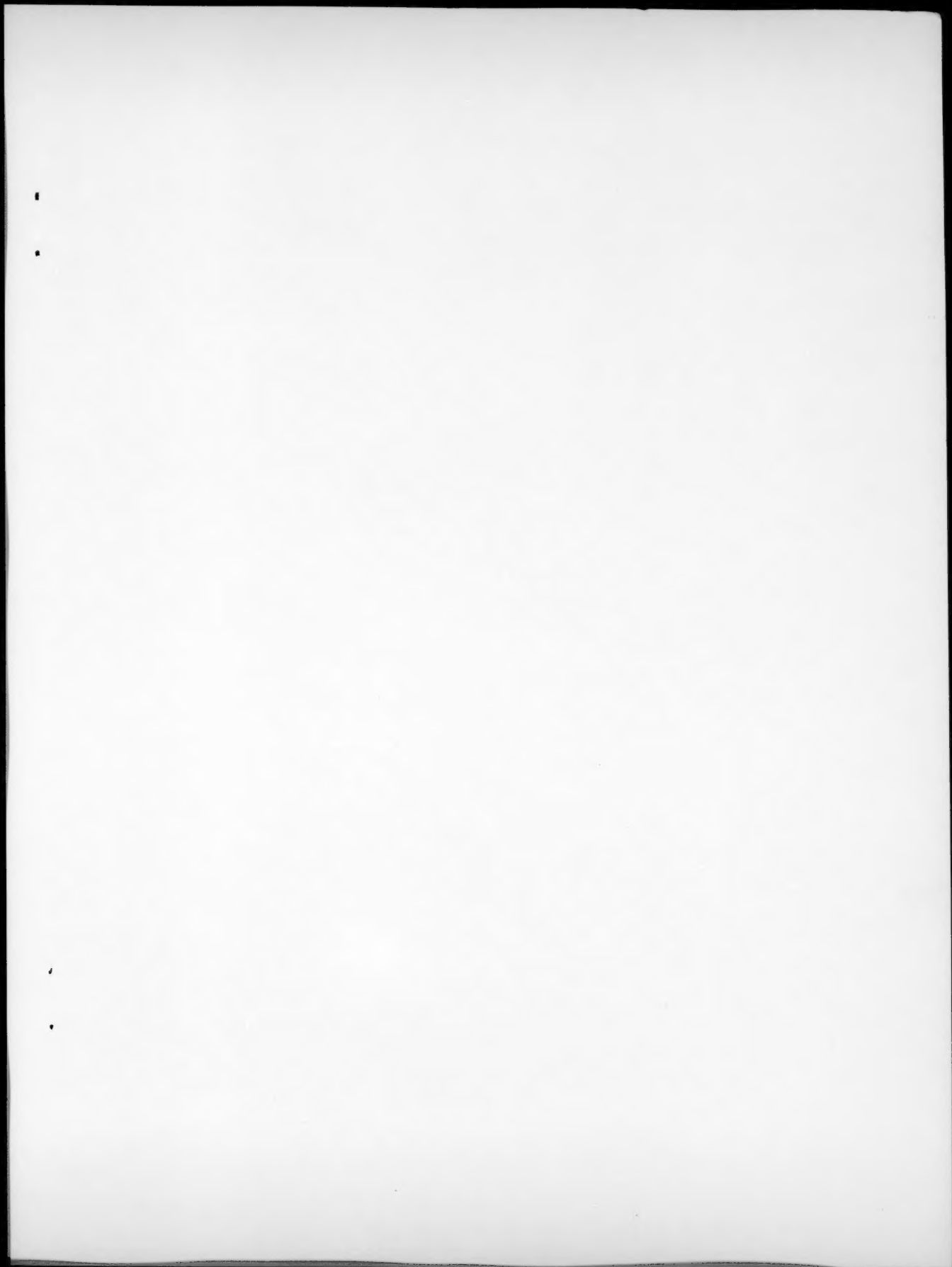


Figure 2.—Observed and computed temperatures of the Chattahoochee River during the period August 1–8, 1976, A, At Atlanta. B, At the Plant McDonough intake.

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